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The Report of JOHN SMEATON, Engineer, upon the State and Condition of *Wells Harbour*, in the County of *Norfolk*.

HAVING carefully inſpected the preſent Condition of the Harbour of *Wells*, in the County of *Norfolk*, and the Slade Marſhes, &c. and other Premiſes, Objects of a Suit, wherein Sir *Martin Browne Folkes*, Bart. and *Robert Hales*, Eſq. were Plaintiffs, and *George Chad*, Eſq. and others, Defendants; and having alſo carefully inſpected the ſeveral Plans and Papers, containing the Evidence produced in the ſaid Cauſe, the following Facts, in Part drawn from my own View of the Premiſes, and in Part from the Evidence produced, appear to me to be well aſcertained and agreed upon.

I. That the Harbour of *Wells* has of late Years grown into a worſe State than it formerly was, and particularly ſince the Embankment that took place in or about the Year 1719. And

The Defts say since 1758

II. That for Remedy of the Complaints then ſubſiſting in the Harbour, in the Year 1738, a Work was conſtructed that had the Name of *Freeſtones*, or *Fryſtan's* Sluice; ſo called from the Projector or Builder thereof, whoſe Name was *Friſtan*.

III. That this Work had a beneficial effect, in ſcouring away the Mud and Sand that annoyed the Harbour and Channel, from the Mouth of the ſaid Sluice down as far as the Pool.

IV. That at that Time, that Part of the Channel called the *Pool* was ſo deep, that at Low Water, two or three Tiers of Veſſels would lay a-float, and ſwing round at Low Water.

It was so, before that time and continued so till 1758-

V. That in the Year 1758, the laſt Embankment was erected, which is the Matter now complained of; and is the Object of the preſent Suit.

VI. That the Quantity of Acres of Ground incloſed and defended by the ſaid Embankment is nearly 17 Acres in the Eaſt Marſhes, and 47 in the Slade Marſhes, together making about 64 Acres; beſides, and interſperſed in which, are Creeks, formerly and now containing Water to the amount of about three Acres, making altogether a Surface of about 67 Acres, or thereabouts.

Seven Acres

VII. That beſides the above, there is not only a very large Quantity of Embanked Land, which was chiefly taken in about the Year 1719; but ſtill a much greater Quantity than all the Embanked Land put together, remains unembanked; over *all* which the Spring Tides *uſually* flowed before the Embankments, but the Neap Tides *rarely*; which is now the Caſe with the greateſt Part of the unembanked Marſhes.

VIII. That no freſh Water River makes its Way to Sea through the Channel of the Harbour of *Wells*, nor indeed any conſiderable Quantity of freſh Water of any Denomination, and that not only the Channel that forms the Harbour, but the ſeveral Branches and Creeks, into which it is divided, (as is particularly diſtinguiſhed in the Map made by *Biederman*, under the Direction of Mr. *Mylne*) are all ſupplied with Sea Water on Tide of Flood, which reflows back to the Sea on Tide of Ebb, and thereby forming a *Backwater*, produces a *Scour* that tends to keep the Channel of the Harbour open.

[illegible]
[illegible] –

IX. That in the Year 1765, *Freeſtone's* Sluice having been originally conſtructed in a ſlight Manner, with Faſſcines, Stakes, Piles, &c. the Mouth thereof was ſo much widened that its Effect had been for ſome Time paſt greatly impaired, and a new One was therefore built upon a new Scite; which when erected re-produced the ſame Effect, as to clearing the Harbour and Channel down to the Pool.

X. That though the Sluice of 1765, had been conſtructed with greater Strength and Care than that of *Freeſtones*, (though upon the ſame Model,) in the Year 1777 it was found to have been nearly deſtroyed with Worms; on which Occaſion Mr. *Wooler* was called in, to adviſe the Commiſſioners, who reported his Advice to build a new Sluice in a new Situation, upon a new Conſtruction, and with ſuch Materials as the Worm would not touch.

XI. That on Account of the Expence, which was eſtimated by Mr. *Wooler* at Two Thouſand Pounds, this Work was not undertaken, but in lieu thereof Proceedings gone into that terminated in the preſent Litigation, on a Suppoſition on a Part of the Commiſſioners, the Defendants, that the taking down the Eaſt Marſh bank, whereby the Tides would be re-admitted upon the Surface of the 67 Acres beforementioned, would reſtore the State and Condition of the Harbour in every Reſpect, or in all the moſt material Reſpects, to what it was before the Erection of that Bank in 1758.

XII. That however, the Sluice ſince Mr. *Wooler*'s Report has been repaired, and appeared at the Time of my View to be of the ſame Conſtruction as it had formerly been; and tending to produce the ſame Effect.

XIII. That during the whole Time ſince *Freeſtone's* Sluice was firſt conſtructed, viz. from the Year 1738, to the preſent Time, the Operation of the Sluices has conſtantly been (when in Order) nearly the ſame, *viz.* that of cleaning and keeping in the ſame good Condition nearly, all that Part of the Harbour and Channel that lies between the Mouth of the Sluice, and the Upper or South End of the Pool.

XIV. That ſince the Year 17~~38~~58, the Pool has been filling up or growing ſhallower, in ſo much, that at low Water, at the Time of my View, there was not above ſix Feet Water there.

[illegible] XV. That for a long Period of Years preceeding all the Embankments, the Outfall or Mouth of the Channel of the Harbour, lay very conſiderably

BRITISH MUSEUM

On this given fact, the Defts are willing to rest their Case

ſiderably more to the Weſtward than at preſent; and that it has from Time to Time changed more to the Eaſt. never changed since 1758

XVI. That formerly, (that is within the Compaſs of the laſt Twenty Years) the Direction of the Channel out to Sea, was N. W.; and that, at that Time the flow of the Tide being in the Direction of the Channel, during all the Tide or Flood, it was eaſy with a proper Wind, to bring Veſſels from the Sea through the Channel, into the Pool and Harbour. with any Wind

XVII. But that ſince the Channel has come more to the Eaſt, and the Direction gradually veered about, ſo as to have now come to a N. E. or N. E. by N. Direction, as it was at the Time of my View, it is a Fact, that whenever the Tide has riſen above the Surface of the Broad Sands, (the Tide ſtill keeping its former Direction from N. W. to S. E.) it drives the Veſſels acroſs the Channel upon the Eaſtern Bank or Sand, and therefore without a ſtrong leading Wind, Veſſels cannot enter without Danger; and in Fact, ſince theſe Changes have taken place, many Ships have been loſt, notwithſtanding the Skill of the Pilots, to the no ſmall Diſadvantage of, and Diſparagement to the Port.

XVIII. That the Diſtance from the Quay to the Outfall of the Channel, is at preſent betwixt Three and Four Miles, and that the Channel both now and ever, has run through large, broad, open Sands, from the Outward or North End of the Pool, to its Outfall into the Sea; which Sand (being perfectly clean, and free from all Particles that might create Tenacity) when dried by the Sun, is capable of being blown by the Wind, and moved by the common Agitation of the Sea, and very great Changes are wrought by the Action of the Sea in great Storms and Tempeſts. And that this is the Deſcription of the Sands in general, which lie extended many Miles on this Coaſt.

XIX. That the Breadth of this Sand, or Diſtance from the Pool to the Low Water Mark, has conſiderably increaſed within the Memory of Man. This leading fact is false

XX. The Channel from the *Shelf*, without the North Part of the Pool, to the Sea, has now as much, (and about the ſame) Draught of Water, or flow of Tide, at High Water, as it has been known to have in Man's Memory. And this is also.

XXI. That the Port of *Wells* is of great Conſequence, not only from its Situation with reſpect to the ſurrounding Country, but alſo from the Traffick ſettled in the Place; and therefore, that nothing ought to be done that can be of real Detriment thereto.

I have thrown together the above leading Facts, not only for my own eaſe in Compoſition, by avoiding more tedious Deſcriptions; but that from this general View of the State of Facts, I may be more readily followed in my Reaſonings thereupon.

From the above, there naturally ariſe the following Queſtions.

I. Is there any Natural Cauſe of the Decay of the Harbour of *Wells*?

II. Whether the Embankment in Queſtion, made in the Year One Thouſand Seven Hundred and Fifty Eight, has contributed thereto?

III. Whether the Removal of that Embankment will contribute to the Amendment thereof?

I. Is there any Natural Cauſe in the Decay of *Wells* Harbour?

To have a clear and comprehenſive View of the Cauſe of *Decay*, it will be neceſſary to ſhew the Natural Cauſe by which the Port of *Wells* has been *formed.*

We are all appriſed, that great as is the annual Downfall of Rains and Snows upon the Land, which run into the Sea, in every Part of the habitable Globe, yet the Quantity of Water contained in the Sea is not increaſed thereby. This may however reaſonably be expected, when we conſider that the Exhalations that form thoſe Rains and Snows, are chiefly raiſed from the Sea, by the Power of the Sun and the Winds.

The Floods and Torrents that make their Way from the Surface of the Lands, in Conſequence of the Rains and Snows, take a long with them a great Quantity of *Clayey*, *Earthy*, and *Sandy* Matter (intermixed with many other Kinds of Matter, which it is needleſs here to enumerate) down into the Channels of the Rivers; the Particles of which are by Violence of the Torrents carried down to the Sea, and there in Appearance diſperſed.

Theſe Particles of Matter not being capable of being raiſed again and returned back to the Land as the Water is, it neceſſarily follows that the Quantity of Sand and Earthy Matter that is depoſited in the Sea, is in a continual, though apparently very ſlow, State of increaſe; and, by the conſtant Flux of the Tides, and the Agitation of the Winds, thoſe Materials ſo depoſited, are capable of being removed from the Parts adjacent to their Entry into the Sea, not only to the neighbouring, but even to very diſtant Parts; and though the remarkable Quantity of Sandy Soil in the County of *Norfolk*, may, in Part account for the vaſt Quantity of Sands upon the Coaſt thereof, (extending as it were in one continued Chain from the Coaſt of *Lincolnſhire*; very much infeſting the great Bay between the two Counties, called the Waſh, and ſtill extending Coaſtways far beyond the Part of *Wells*, even to *Cromer*.) Yet it is by no Means neceſſary to ſuppoſe, that they have all, or in the *greateſt Meaſure*, proceeded from the Land of the two Counties, to the Coaſts of which they now lay contiguous; they may as well have proceeded from Parts far more diſtant; and brought hither by the inceſſant Action of the Winds and Tides, they find a Place better adapted to their Reception and Repoſe than thoſe from whence they came: And indeed it may be not improbably ſuppoſed that they in *part* have come from thoſe Coaſts, which by the particular Set of Winds and Tides, have been *waſting* for Ages paſt.

It is however of no Conſequence to our Argument to point out from *whence* they came; it is ſufficient that they have come, and that being here depoſited, and finding it a Place where they are leſs liable to be removed away, than to be brought hither, the Quantity upon the Whole *muſt increaſe*; and ſince there appears no Power of Nature, by which they can be returned to the high Grounds or Coaſts from whence they came, it muſt follow, that they muſt *continue to increaſe*, till ſome contrary Power of Nature ſhall take Place, that we are not acquainted with; or the Place of their Reception become entirely filled.

It

The same Causes which brings in Sands will carry them out again

That part of Lincolnshire, which Communicates with the Sea, is not Sandy, tho' all Sea Coasts are so –

It follows then, that the Attachment of Sandy and Earthy Matter to this Coaſt, is in *a progreſſive State of increaſe*, which it is as much out of any Human Power to prevent, as it is to prevent the Sandy and Earthy Matter from being brought down from the High Grounds into the Sea.

We need not therefore extend our Views farther, to be enabled to ſee clearly; that in ſome forner Age, that is, in ſome State of Progreſſion of this great Work of Nature, there was a Time, when there was nothing more than a naked Sand, laid againſt the bare Coaſt of the elevated Ground, upon which the Town of *Wells* now ſtands; (which we may ſuppoſe ſimilar to that, which now lays between *Wells Miels*, or *Marram Hills*, and the Low Water at Sea) which being upon one regular decline, the Tidal Water could flow and reflow over the Surface, without Channel or Creek; and in this State, as there could be no Harbour, there would not, on that account, be need of a Town; but let the Breadth of the Sand gradually increaſe to double, and then the Declivity would become too ſmall, for the Tidal Water left by the Flood, to make its Retreat, ſo as to keep pace in its return with the Ebb at Sea; and therefore a body of Water being thus left behind, and having a ſenſible Declivity towards the Sea, would naturally make its way in the loweſt Slades, and there cut a *Gully*, which (if not formed gradually as may rather be ſuppoſed) would ſoon be enlarged by the Influx and Eflux of the Tide, and thereby a Scour would be produced through this Paſſage, enough to keep it open, in a Degree ſufficient to let the Water in and out, till it became ſo quiet, as in a Manner to ceaſe the Operation of Scouring. But the Breadth of the Sands ſtill gradually increaſing, a greater Body and Surface of Water, will want a Paſſage, and the Power of ſcouring will increaſe with it; the Gully will therefore by the ſame ſlow Degrees enlarge to a *Creek*, or *Fleet* as it is here called; and leſs ones will be formed to conduct the Water more readily into the larger.

Wells stands on a Chalk

the tide always Ebbs Gradually

The Natural Progreſs attending this Operation is, that the Parts of the Sand the furtheſt diſtant from Low Water, being the leaſt liable to be agitated by Winds and Tides, the Sands intermixed with the finer Particles of Earthy and Clayey Matter, brought in by the Tide, are the moſt readily and quietly lodged there; and particularly the Earthy and Clayey Particles will find a reſting Place, which binding the Sand together, the Whole will continue to riſe, till at *a certain height*, and in Conſequence of a certain length of Time of abſence, of the Salt Water each Tide, and expoſure to the Sun and Air, the Surface becomes fitted for Vegetation; and by Degrees, will produce a certain Species of Graſs, and become a *Salt Marſh*; and which Graſs entangling and locking up the Earthy Matter, will make the Surface continue to riſe; and ſtill the faſter, as the Water upon the plain Graſs Surfaces becomes more ſhallow; and in Conſequence, more ſtill, quiet, and free from the Agitation of external diſturbing Cauſes.

During this Period, as the Marſhes have increaſed in Height, they have alſo increaſed in Breadth; and in Conſequence, a greater Body of Water will be left upon them. The Gullies and Creeks therefore, as they increaſed in Number with the increaſe of Breadth, the larger ones would increaſe in Size and Depth; and if all were ultimately collected into one, as has been the Caſe with the *Channel* of *Wells* Harbour, the Scour would be ſufficient to maintain a Channel, through which Veſſels may be brought from the Sea; and thus an *uſeful Harbour* would be formed, which would increaſe in Depth and Utility, by the continuance of the forming Powers; but yet, only to a *certain Degree*.

I have ſaid, that as the Marſhes increaſed in Breadth and Height, more Water wanting its Paſſage to Sea, would be left upon them; and this, ſo far as it regards Breadth, is ſelf-evident; but as the increaſe of Height diminiſhes the Depth of Water upon them at High Water, that the Quantity left behind upon the Whole will be greater, needs ſome Explanation.

In reſpect to this, it is obvious to every one that views the Subject, that while the Depth of Water upon the Marſhes is conſiderable, the Water makes its way to Sea by ſettling gradually, and paſſes off in the neareſt Direction, over the Marſh Surfaces, without having any need for the Gullies and Creeks, as Drains; it is therefore, perhaps, only the laſt half Foot that may need the Gullies; which however, being thus limited to ſome certain thickneſs, (be it half a Foot, more or leſs) and this Thickneſs much leſs than the Depth at High Water, the Quantity ſo left will be in proportion to the Quantity of Surface; and the number of Gullies, being alſo in proportion to the Surface, the agregate of the Whole, and the Scour thereof in the laſt Channel, will be proportionably increaſed alſo. It is alſo to be remarked that in fact, the Scour is not very material, till the Water upon the Marſhes is ebbed near their Surface; that is, juſt retreating into the Gullies, when the principal Scour begins.

Under theſe Circumſtances, the *Scour* and conſequently the *Harbour* of *Wells* would materially increaſe, while the Neap Tides covered the Surface of the Marſhes; but as the ſame Progreſſion would, in time, cauſe the Surface of the Salt Marſhes to riſe above the ordinary Neap Tides, the Scour would then begin to diminiſh; becauſe being not only deprived of the Eflux of the Water, from the Graſs Surfaces into the Gullies, a number of Times in a Fortnight, the Scour of theſe Gullies becoming immediatly leſs, they would themſelves begin to choak up, and contain leſs *following* Water; and therefore in both Reſpects, the Scour being diminiſhed in each particular Gully, the Scour of the Whole muſt be diminiſhed alſo.

It is moſt probable that this Harbour, from the ſlow Progreſs of the Changes above ſpecified, may have continued in a very flouriſhing State for a long Term of Years, reaching backward beyond all Record; though for a Part of that Time, it may have been in reality in a ſtate of *Decay*; and which we will now ſhew, will naturally reſult from the ſame Progreſſion of Cauſes, that carried it to its *Maturity*, ſo that after having clearly ſeen from what natural Cauſes the Harbour has been produced out of the Sea, without a freſh Water River to give it Birth, we ſhall then readily ſee the Natural Cauſes, to which its *Decay* muſt be attributed.

From what has been laid down it will appear moſt manifeſt, that the Riſing or Elevation of the Surface of the Salt Marſhes, by a freſh Acceſſion of Sea Mud, which they will acquire more or leſs every Time they are overflown, will not ſtop at the *Neap Tides*, but they will gradually riſe higher and higher, towards the high Water Level of Spring Tides; and if after that, they were only to be overflown in the great Springs or *raging Tides*; yet as every one of theſe Tides will depoſit ſomething, they will ultimately be ſhut up at the Height of the extreme High Water, though no Embankment whatever was to take place; and this will alſo happen in ſucceſſion, to the Gullies, Creeks, &c.

The Sea always retreats

For as the Surface of the Marſhes riſe higher and higher, from the Neap towards the Spring Tide Mark, they will be leſs and leſs often overflown; and the Gullies made by the Reflux of the Tidal Water from their Surface, Here *Sea Mud* becomes auxiliary, (for the *first time*) to the *Land*: According to this Hypothesis the Sea must have retreated from all Eternity, the contrary of which is the fact here —

(a) The Question cannot depend upon the *Quantum* – For Instance, if the Waters in V
were *barely sufficient* to Scour the Channel, and to act upon their Reflow as a Ballan
It against the Western Tide at Sea, the loss of *one Single Bucket* of those Waters would tak
to away that Ballance, and give the Western Tide a Superiority – What must be the Conseq
The Scour would be lost – The Harbour choaked up, and the Western Tide, not being co
acted or ballanced by a contrary Power of Sufficient Weight, would have forced the Har
Mouth towards the East – Compare this with the facts in this Cause, and it may be eas
seen that for want of the Waters from *Warham Slade*, the Ebb Tide at Sea (acting witho
opposition) has produced all the Grievances, under which the Harbour has labou
since 1758 –

Surface, will become leſs and leſs conſiderable and capacious, and in Conſequence of Want of re-flow the Creeks will ſuffer the ſame Fate, and laſtly the *Fleets and main Channel*. But as the Tidal Water flowing in through the Channel, Fleets, Creeks and Gullies, to the ſeveral Extremities of its Branches, muſt flow back the ſame Way, it is the Extremities that will be firſt landed up; becauſe every Part betwixt ſuch Extremity and the Sea will have Water beyond it to flow over or through it; and thereby producing ſome Degree of a Scour, will keep open a Paſſage either greater or leſs, while any Water can get beyond it; and hence we are to expect that the Parts of the Channels, the moſt diſtant from the Sea, will be thoſe that in a State of Nature will ſooner looſe their Depth and Capacity, till progreſſively from the Extremities towards the Sea, the Gullies, Creeks, Fleets and main Channel will become ſolid Land: And ſo far it appears from Teſtimony, that long before the Embankation, in the Year 1758, Nature had got ſo far in its Progreſs in the Decay of *Wells* Harbour that it was much complained of, and the upper Part between the Quay and the Pool was got ſo bad, that the Goods were in general Lightered up to the Quay; and that for Remedy thereof, *Freeſtone's* Sluice was built in the Year 1738, which produced a good Effect in clearing that Part of the Harbour; and as it plainly appears from the preceeding Diſcourſe, that the Progreſſion of Nature has no Tendency to *cure the Evils* complained of, but ſtill to increaſe them; in Conſequence they are incapable of any Remedy, except what can be applied by the Ingenuity and Labour of Man.

What Progress

The Imbankment of (1719) caused the Decay

2 Sluices

We now come to the Second Queſtion, whether the Embankment made in 1758, has contributed to the Decay of the Harbour of *Wells*.

From what has preceeded it has been clearly ſhewn that as the keeping open and maintaining the Channel entirely depends upon the Re-flow of the Tidal Water, or *Back Water*, as it is called, that whatever cuts off and diminiſhes this, muſt be a Detriment to the Scour, and conſequently to the Maintenance of the Channel; I therefore do not heſitate in ſaying, that all the Embankments both Eaſt and Weſt of the Town of *Wells*, whoſe Waters (received upon their Surface, and into their Gullies, and Creeks,) made their Way back to the Sea by the Channel of *Wells* Harbour, co-operated with the Progreſſion of Nature, and thereby tended to bring on, more *ſpeedily*, a General *Want of Depth*; which as it has been already remarked, will be firſt perceived at theſe Parts of the Tidal Flow, the moſt remote from the Sea: Nay we may go ſo far as to ſay, that if a Bucket of Water is taken up in the upper Parts of *Wells* Harbour, and not ſuffered to Re-flow, it may prevent the diſplacing of ſome Particle of Matter, that had been lodged therein, by ſome preceeding Tide: And in this Sentiment I ſuppoſe every Engineer and ſkilful Perſon, that has viewed the Premiſes will join, as a *General Opinion*; and which though very true as a General Sentiment, yet the whole Merit of the Queſtion, depends upon the *Quantum*, the *how much* Damage, could reſult from thoſe artificial Means. And as in this it appears, that the Opinion of different Men have widely differed, I will proceed to ſtate my own, with all the Preciſion and Clearneſs I am able.

what Progression

(x)

Now as the Breadth of the Sands continues upon the Increaſe, we muſt conclude that the Reflux of the Tidal Water from the whole Surface covered, continues upon the whole, if not greater, as great as formerly; and therefore will maintain as good a Channel to Sea at the Out-fall at low Water; nor does it appear from any Teſtimony, that from the Scolph to the Out-fall of the Channel into the Sea, there is a leſſer Depth at *high* Water than formerly there was;

This is an Impudent Falsehood -

was: the Complaints and Appearances of a Diminution of Depth of the Harbour, are from the lower or North End of the Pool upwards, towards the Town. It appears, therefore, that as the upper Part of the Channel that lays contiguous to the main Land, is *landing up*, in Fact the Harbour is moving *towards the Sea.*

It does not appear from Teſtimony, that the filling up of the Pool or its growing ſhallower, (ſo that Ships cannot now lay a-float, or ſwing round in Tiers, as they uſed to do at low Water) has been a Matter very much complained of, 'till ſince the Embankment in 1758: but this does not hinder, but that the fundamental Cauſe thereof may have exiſted, long before the ill Effects have become ſenſible to Seamen, and thoſe uſing the Harbour; and indeed it clearly appears to me, that the filling up of the Pool, ſooner or later, is only a Link in the general Chain of Cauſes, that muſt operate ſo as to produce this Effect, whether any Embankment had ever been made or not.

Mariners never let go their Anchors with Sounding the Depth.

To ſee this clearly, we have nothing to do but to advert to the Situation of the Pool; for it begins juſt below or about where the *Weſt Fleet* falls into the main Channel. This Fleet receiving the Drainage and back Waters from the *Holkam* Marſhes, appears to have been anciently of much greater Extent than at preſent; and conſequently the back Water, or Re-flow, muſt have been very conſiderable from this great Extent of Surface, as well as that which ſtill lays unembanked; and which being joined by the great Re-flow of Water from the *Eaſt Fleet*, the *Little Fleet*, and the *Haven Creek*, with all their extenſive Dependencies, muſt form a great and rapid Scour of back Water: and when it is adverted to, that it is confined into a narrow Compaſs between the *Holkham* and the *Wells Marram* Hills or Miels, we muſt expect no leſs than a very deep Channel in this Extent, well deſerving the Name of *the Pool.*—— That this Confinement of the whole Water, both of Flood and Ebb, between the Hills juſt mentioned, gave an additional ſcouring Power to the tidal Water, appears further from this; that the Pool never appeared to be of further Extent Northward, than till this Opening between the Hills is cleared, when the Tidal Water having Opportunity of eſcaping on Tide of Ebb, over the broad Sands laying without thoſe Points, its Force became diſſipated, and the great and ſudden Scour ceaſed, that cauſed this deep Water; even in that Age, when the whole Scour was in its greateſt Degree of Strength and Perfection, and the Depth and Goodneſs of the Harbour conſequent upon it. But whenever (as has been ſhewn) the Scour beyond it became diminiſhed, by the Riſing of the Marſhes above the High Water of *Neap Tides*, the Depth of the Pool would begin to diminiſh; for the Scours would then be unable to ſcoop out the Sands, which would be continually brought into it by the N. W. Winds from the broad Sands laying to the North thereof, through *Holkham* Gap, and down the Weſt Fleet from ſo great a Depth as before.

Nor is the *Holkham* Gap the only Reſource from whence the Sands brought down by the Weſt Fleet, might be collected: for I look upon it, that the Inſide (that is, the South Side) of the *Holkham* Miel Hills, are continually melting down by Winds and Rains, into the great Area or Bay, drained by the Weſt Fleet, and thoſe Hills are continually ſupplied with freſh Sand, blown up by the Force of the N. and N. W. Winds, from the broad Sands, that are yearly extending more and more, from thence to the Northwards into the Sea: the higheſt Parts of which broad Sands, being frequently left at Neap Tides long enough to be dried by the Sun, are, by the *Wind*, capable of being blown up in great Quantities, ſo as to make and continue thoſe Hills far above the High Water of any Tides whatever; though compoſed of nothing more than a blown Sand, ſomewhat united

[illegible]—

by

How could the decay of the Harbour happen without being sensible to those, who daily trusted their Lives to its Goodneſs and Safety—

(a) This is false – The Pool never began to grow shoal till 1758

Here he allows the ill Effect of the Embankments of 1719 – but the Embankm
of Warham Slade is very harmless – Fie for shame

(b) This is false – The Surface Waters went to Sea with the Eastern Side at
[illegible]

by the *bent Graſs* that grows up through the ſame; of which there are very many Examples in various Parts of the Kingdom.

In that Age when the Scour at the Pool was in its full Perfection, it is probable that it was very much deeper than it has ever been reported to be by any Teſtimony or Record now extant: and ſo long as it continued deep enough for the Purpoſes of Shipping, there would be no Cauſe of Complaint: and till it became too ſhallow for Ships to ſwing at Low Water, its Diminution of Depth would be little regarded. There is therefore no Doubt but that the Pool was (a) growing ſhallower long before the Embankment of *Holkham* Marſhes; as a conſiderable Length of Time muſt have elapſed, between the Time when *Holkham* embanked Marſhes were juſt riſing above the High Water of Neap Tides, and their acquiring the Height at which they were embanked; and which Height, I judge, was not materially different from the preſent. 1719

When the Ground of *Holkham* Marſhes was become high enough for Embankment, the natural Scour ariſing therefrom, was doubtleſs greatly diminiſhed from what it had been; and though they had not been embanked, it would have been ſtill much leſs at this Day: Yet ſo great a Surface as 560 Acres, (the Drainage of which plainly appears to have made its Way out to Sea by the Weſt Fleet) being cut off all at once in the Year 1719; and 108 Acres more in the Year 1721; the whole of this together amounting to 668 Acres, may reaſonably be preſumed to have had ſome ſenſible Operation, in accelerating the Effects, that Nature in her Progreſſion would afterwards have brought on, though no artificial Embankment had been made: but it by no Means follows, that the Effects of thoſe Embankments muſt be *immediately* perceived at the Pool: this, by ſlow and imperceptible Degrees, muſt be ſuppoſed going on before; and by leſs ſlow, but yet imperceptible Degrees, might be going on after. Yet this muſt be attended to, that in Proportion as the Scour of the Weſt Fleet was diminiſhed by the Loſs of the embanked Marſhes, the Power of the ſame Scour would be diminiſhed, to carry down the Sand continually into the Pool, in the Degree in which it had uſed to do; ſo that till the great Bay, which ſtill continues to be drained by the Weſt Fleet, was, as it were gorged with Sand from *Holkam* Gap and *Molkam* Miels, it would not be brought down in ſo great Quantities each Tide, as uſed to have been before the *Holkam* Embankment, and therefore, as it appears that the whole Progreſs of this Buſineſs is very ſlow, it muſt be expected to have been a Series of Years between the *Cauſe* from the *Holkham* Embankment and the *Effect* becoming more perceiveable, in the ſanding up of the Pool; and in Caſe this neceſſary Period of Years extended from the Year 1720, to the Year 1758, (that is, near forty Years;) at which Time the laſt Embankment was made, then thoſe would become cotemporaneous Events; and it would be no Wonder, that the united Effects of the *Holkam* Embankment, and that of the Church Marſhes in the Year 1719; and alſo of the Weſt Marſhes of *Wels* in 1720, making in the Whole 572 Acres; together with the additional Loſs of Scour from the Surface of the Salt Marſhes, which yet remain unembanked, to the Amount of between 15 and 1600 Acres, (the Drainage of all which have their Outfall through the Pool:) I ſay, it would be no Wonder, if under theſe Circumſtances, the united Effects tending to land up the Pool, ſhould be charged to the Account of the Embankments made in the Year 1758; if it was poſſible to ſuppoſe that the Embankment made that Year, of 64 Acres, could have a ſenſible Effect; as the Object of this Embankment amounted to no more than 1-34th Part of the whole Quantity concerned in producing it; when it remains *problematical*, whether the Effect of the 572 Acres taken in before, (which is near nine Times as much) would alone have been ſenſible,

But would it have been none at all

(b)

false

ſible, if the Effect thereof had not been mixed with what might have ariſen from Nature's ſimple Progreſſion, in caſe its Operation had been no Ways diſturbed by thoſe of Art.

I find myſelf, therefore, forced by fair Induction to infer, that though ſtrictly ſpeaking, the Effect of every Thing that has an Effect, muſt be ſomething; yet, that the Embankment of the *Slade* Marſhes in the Year 1758, could not in any ſenſible Degree, capable of Meaſure or Eſtimation, contribute to the Landing up of the Pool.

The Effect thereof upon the outward Part of the Channel muſt be ſtill more remote; for it does not appear from any Principles of Art, Obſervation, or Practice, that when a back Water, even aſſiſted by a freſh Water River ever ſo large, makes its Way through broad moveable Sands, it has any Tendency in itſelf to make its Way out to Sea, in this Direction more than in that. The natural Tendency of Water, is to make its Way in whatever Direction it finds the *greateſt Declivity*, and if that happens to be in the ſhorteſt Direction, it has no natural Tendency to gain a longer Courſe, as that would leſſen the Declivity. If Water, therefore, is found going in a Courſe that is not the ſhorteſt, we may conclude (and in examining we always find) that this longer Courſe is owing to the Intervention of ſome Object; ſo placed that the Water can have in that particular Part, a more ſpeedy Deſcent, in a Direction different from that which would form the ſhorteſt Line of the whole Deſcent; and from Cauſes of this Kind, a Stream may have a Courſe in every poſſible Degree meandring, as we frequently obſerve in Nature.

If, therefore, the Courſe of the outfall Channel to Sea at Low Water, was in a North-weſt Direction, through the broad Sands, as ſeems very well atteſted to have been the Caſe in former Times; and if, at thoſe Times, the Courſe of the Channel correſponded with the general Set of the Tides upon the Coaſt, ſo that Veſſels going in or out through the outfall Channel, were not driven out of their proper Courſe, by a Set of the Tide, acroſs the Channel, as is ſaid to be the Caſe at preſent, it may be imputed to ſome of thoſe lucky Cauſes, that operated in favour of thoſe Times; as no Strength of back Water alone, could have a natural Tendency to produce this Effect. And if the accidental Operation of contrary Cauſes, as ſuppoſe Winds and Tides (either conſidered alone, or as acting in Correſpondence with the regular Progreſſion of Nature already deſcribed) has brought the Direction of the Out Channel, into a Situation leſs favourable to Navigation than it uſed to be formerly; at the ſame Time it has produced a ſhorter Courſe for it to Sea, than it would have, if returned to its former Direction. I am, however, clearly of Opinion, that no Increaſe of back Water even if added by a freſh Water River, if artificially brought down, would ever cauſe it to return to its former North-weſtern Direction, ſo as to diſembogue itſelf at a Place conſiderably more Weſt than the preſent.

a Back Water
would [illegible] for
this purpose

I do not, however, mean to ſay, that it *cannot return*; but that if it does, it muſt be in virtue of Cauſes operating in a contrary Way to thoſe which have brought the Mouth of the Channel from the Weſtward towards the Eaſt, and not in virtue of any Change that can be expected to be wrought, ſimply by an Increaſe of back Water; for that would be to make a more rapid ſtream, have a Tendency to go a longer Journey to Sea in *preference* to a ſhorter.

Flowing Waters are heavy bodys descending in an Inclined Plain — If they meet with no Obstruction they descend in a right Line, and they try by their Momentum to force thro' any Obstruction — If that cannot be done, then they Straggle or find their way by a Course where there is no Obstruction — Where it hath gone Strait and is Obstructed, the tendency to going Strait always continues —

Blakeney Harbour has been ruined by Embankments

(a) The Bank [illegible] at this time at dead low Water five feet high, half a furlong over [illegible] half a mile long

It is alledged, indeed, that from a general Increaſe of the Breadth of Sands upon the Coaſt, that it is now further from the North End of the Pool to the Sea than it formerly uſed to be; but this muſt be underſtood of the ſtrait Line from the ſaid Point to Low Water, without Regard to the Direction of the Channel, for though the preſent Channel ſhould be as long from the Pool to the Sea, or longer than formerly, yet from the general Increaſe of the Breadth of the Sands, was the Channel to go much further Weſtward than now, it would have a longer Courſe to Sea at Low Water than at preſent.

Whatever may have been the particular Cauſes that have brought the Mouth of the Channel more to the Eaſt than formerly, does not appear material to the preſent Queſtion; but to give Satisfaction as far as I am able, I will hazard the following Conjecture. It is an Obſervation univerſally agreed upon, that the N. W. Winds make the higheſt Tides in the whole *German* Ocean; the N. W. Winds then accompanied by higher Tides will produce more Agitation, and conſequently carry more Sands from the N. W. Eaſtward, than equal Winds from the S. E. accompanied with leſſer Tides, will bring back; and as to the N. E. Winds they, according to the local Direction of the Coaſt here, directly tend to accumulate them upon the Shore; and if this is a true Solution, as I apprehend it is, there ſeems not the leaſt likelihood, that the Direction of the Channel ſhould ever be permamently removed to the Weſt, but rather that it ſhould be carried further to the Eaſtward than now it is: And what gives Strength to the above Conjectures, is an Obſervation I had the Opportunity of making upon my View, *viz.* That the Outfall Channel of the Harbour of *Blakeney* (a few Miles Eaſtward of *Wells*, and ſituated in a ſimilar Manner, in Regard to the Courſe of its Outfall Channel through the broad Sands) has ſhifted alſo more to the Eaſtward than it was, by above Half a Mile in the laſt ſeven Years; as appeared from the Marks I was ſhewn for its Entry at that Period, compared with its preſent Place, notwithſtanding that *Blakeney* Channel has the Advantage of two large freſh Water Rivulets, that make their Way together through this Channel, to its no ſmall Advantage towards keeping it open. The Place alſo of the Out-fall at low Water, of the Eaſt diſcharge from the ſalt Water Creeks, called *Warham Deeps*, I was ſhewn to have removed its Place further Eaſtward, than it was at Michaelmas laſt, by ſeveral hundred Yards, and chiefly within the Compaſs of the Three Weeks preceding my View, during which very Strong North-weſterly Winds had prevailed. *N. B. Warham Deeps* lay betwixt *Blakeney* Out-fall Channel and that of *Wells*.

This is the
[illegible] Question
in the Cause

There is only
one fresh Water
Rivulet — Mr
Hughes [illegible]
Book fo 3

There is one Thing more reſpecting the Out-fall Channel of *Wells* Harbour, that it may be proper to touch upon, and that is the Bar, that is deſcribed in *Biederman*'s Map, to lay acroſs the Mouth of the Channel, ſo as to be prejudicial to the Entry of Veſſels; but after what has been ſaid, be the Impediment ariſing from hence greater or leſs, it cannot be imputed to the Embankment of Marſhes, but to the Sport of the Winds and Seas at the Place, which will further Appear from this Circumſtance: That when I was examining this Place at dead low Water of a ſpring Tide, *viz.* the 15th of *March* laſt, I did not obſerve there was any Appearance of a Bar, the Courſe of the Channel being right out to Sea, at N. E. by N. by the Compaſs; yet in another Seaſon it may probably return. (x)

Hence from the above Premiſes, I muſt entirely acquit the Whole of the Embankments, as having been, in any Degree, acceſſary to the diſagreeable Effects ariſing from the Change of the Out-fall Channel of *Wells* Harbour;

what

what I have further to ſay will come moſt naturally under the third and laſt Queſtion propoſed.

III. Whether the Removal of the Embankment of the Slade Marſhes, will contribute to the Amendment of *Wells* Harbour?

It appears clearly from what has preceeded, that the progreſſional Operation of Nature, which originally formed the Harbour of *Wells*, and brought it to Maturity, is, by its Continuance, gradually producing its Decay, and finally will cloſe it up, and convert into firm Ground, fit for Arable Purpoſes and thoſe of Paſturage, the very Spots where Ships have rode at Anchor; and that this Progreſſion of Nature cannot be countervailed in any Degree, but by the Induſtry, Art, and Hand of Man.

It is a Fact well eſtabliſhed by Evidence, that previous to the Erection of *Freeſtone*'s Sluice, in 1738, the upper Parts of the Harbour, as far down as the Pool, had got landed up to that Degree, that the Shipping that chiefly lay in the Pool, were obliged to have great Part of their Ladings brought and carried to and from the Town by Lighters. That upon the Erection of *Freeſtone*'s Sluice (which as far as appears was the very firſt attempt in this Harbour, to counteract the Operation of Nature by Art) this rude and ſimple Piece of Art, ſucceeded ſo far as, in a very great Meaſure, if not effectually, to relieve the Diſtreſs that they then laboured under; viz. that of the Quays being in a great meaſure inacceſſible to Shipping; (a Conſtruction ſo rude, that though bearing the Name of a Sluice, would ſeem as if it had been one of the firſt Attempts to obtain Relief by Art, before Sluices had been invented;) and hence we may infer, that if this did ſo much, what might have been done by a *real Sluice*, built upon a proper and regular Conſtruction. This Sluice was attended with a beneficial Effect, ſo long as it laſted; and when it went to Decay, the Part of the Harbour affected thereby, reverted to its former State.

In the Year 1765, they again ſet about to relieve themſelves, not by building a Sluice upon a better Plan, but by erecting a new one on the ſame Plan, upon freſh Ground, with better, and as they expected more durable Materials; and this Sluice reproduced afreſh the Effect of the former, which has indeed continued to this Day; but in the Year 1777, it was diſcovered to be defective, and liable to fail on account of the Timber wherewith it was built, being eaten with a Sea Worm, that had attacked it, unknown in theſe Parts before. On this Occaſion Mr. *Wooler*, an ingenious Engineer, was called in; who very judiciouſly adviſed, not only to build a new Sluice, upon a new Foundation, and of more durable Materials, but of a different Conſtruction, ſo as to give a better Effect to the iſſuing Waters; and as the beſt Means of preventing the Harbour from going into a total Decay. This ſalutary Advice however, appears to have been rejected by the Commiſſioners of the Harbour, on Account of the Expence; and, in Lieu thereof, they adopted another Expedient, which they thought was liable to be attended with leſs Expence, and would be quite as effectual; for, having obſerved, on popular Grounds, that as many Things had gone wrong with the Harbour ſince the laſt Embankment, in 1758, they concluded them to be the Effects of that Cauſe; and that removing the Cauſe the Effects would ceaſe, and every Thing come right again. It ſhall be therefore now my Buſineſs, fairly and fully to examine, what Foundation there was or may be, for ſuch a Suppoſition.

[illegible]

It

Vide Boydon and the other Witnesses Testimony

Vide his Report on Lynn Channel -

This is an attempt to Impose upon the reader, ~~but~~ by putting the Slade Waters into the same Scale with those of the Salt Marshes—

It appears to me that there were no juſt Grounds for their Expectations. For in the Year 1738, the Waters of the Slade Marſhes, had not been interrupted in their Operation, and yet the Harbour became choaked, and got into ſo bad a Condition, as to call aloud for immediate Relief. What Reaſon then to expect it in the Year 1778, when according to the natural Progreſſion every Thing had got worſe? In 1758, *Freeſtone's* Sluice had gone to decay, and the Harbour was ſpeedily reverting to the State in which it had been before in the Year 1738. Now, had the Operation of the Slade Marſh Waters been obſerved to have been of any material Conſequence, the Embankation in 1758, would have been oppoſed and objected to at the Time, which yet does not appear; and had any ill Effects appeared to have ariſen from the Embankment, in the Year 1768 (that is ten Years after the Embankment, and three Years after the Re building of the Sluice) when an Application to Parliament was neceſſary to get *freſh Powers* to defray the Expences incurred, by that Erection, &c. it would have been natural to have endeavoured to get ſome Equivalent for the Damage; or, at leaſt (as Sluice Building muſt then appear to be the beſt Expedient) to have got Powers over the Grounds in the unembanked Marſhes, to have enabled them to erect ſuch proper additional Works, as might from Time to Time be neceſſary, (and which might have been expected upon eaſy Terms, and without depending on Leave being always given) in caſe any Damage to the Harbour had been felt or apprehended from the Embankment; becauſe, the more amicable the Terms that ſubſiſted at that Time between Sir *John Turner* and the Commiſſioners, the leſs he could have oppoſed or denied ſo reaſonable a Requeſt: But yet nothing of this appears, or indeed any other till after the Year 1777, when Mr. *Wooler* had reported, that a proper Sluice was of the utmoſt Importance, towards keeping the Channel of the Harbour open, and clear of the Sands that are conſtantly brought in by the Tides; and that ſuch a Work would probably coſt the Sum of 2000*£*.

Channel
not been
[illegible]

only the Quay

[illegible]
[illegible]
[illegible]

Mr [illegible]
[illegible]
[illegible]
the Plaintiff
[illegible] formed

Reſpecting that Part of the laſt embanked Marſhes that lays Weſt of the Antient Embankment, comprehending 16 Acres, it is evidently of no more Account than any other 16 Acres, that lie immediately upon the *Haven Creek*, whoſe Waters immediately ebb with the Tide, without paſſing through the Sluice: that is, they could have no other Effect in ſcouring, than as making a Part of 1770 Acres, that make their Way to the Sea by the Pool: But, with reſpect to the 47 Acres that lie Eaſtward of the ancient Embankment, and are called the *Slade*, or *Slade Marſhes*, they appear to me to have a different Import.

The Reaſon why the Waters paſſing the Sluice have a greater Effect in ſcouring, than thoſe which return to Sea without paſſing the Sluice; is becauſe by the contracted Opening of the Paſſage of the Sluice, the Waters that lay in the Creek behind it, are detained from ebbing ſo quick, as they otherwiſe would have done: That is, their numerous Mouths (which when always open, reduced the Level of the Water contained therein, to near upon the ſame Level as that of the Water in the main Channel of the Harbour) being ſtopped by Dams made acroſs, and united by croſs Paſſages into one, and the Mouth of this being contracted by the Work called the Sluice; a Body of Water is held back in theſe Creeks as Reſervoirs, which not being able to eſcape ſo faſt as the Tide ebbs in the main Channel; it follows, that a Body of Water by theſe Means is vended upon, and after the half Ebb, which diſcharging itſelf into the Harbour, forms a Scour when the Depth is ſo much leſſened, as to operate with Power in grinding the Bottom, whereas otherwiſe it would have been ſo languid as not to have ſtirred a Grain of Sand or Mud. This artificial Scour thus procured, in ſome Degree imitates the

the Effect of a freſh Water River, which in theſe Situations is very greatly beneficial; not from any Virtue there is in freſh Water preferable to Salt, in theſe Caſes (if any Thing it is rather leſs, on Account of its leſs ſpecific Weight) but from its having a Fall from the Land, and proceeding therefrom *continually*; it not only ſtrenghtens the Ebb, but running to Sea at Low Water, (when the Fall being greateſt, and the ſandy Bottom expoſed to its Action) it continues to work, at a Time when it can work to the beſt Advantage: And when the ordinary Current of the River is aſſiſted by extraordinary Land Floods and Freſhes, from Downfalls of Rain and Snow, (and this operating at Low Water, when, as juſt remarked, the Fall is the greateſt) in ſuch Caſes it is capable of producing extraordinary Effects; and of keeping an Harbour continually open (with a Channel of given Magnitude) though loaded with Sands in any poſſible Degree; for a freſh Water River has this peculiar Advantage, that at the ſame Time that it ſtrengthens the ſcouring Power of the Ebb, and operates moſt forcibly at Low Water (when there is the leaſt to obſtruct its Operation) it oppoſes the Tide of Flood from the Sea, and thereby prevents it from bringing ſo much Sand and Silt into the Harbour as otherwiſe it would.

The Defect, therefore, of this Sluice of *Wells* is, that though it retains the Waters, ſo as to be behind the general Ebb, and thereby ſtrengthens the latter Part of it conſiderably; yet, being at Low Water, all ſpent (when the greateſt good might otherwiſe be obtained) it looſes that good Effect which would be had from a freſh Water River, or from a proper Sluice; that is, one that will retain the Water wholly till a proper Time of Tide, and by then letting it off in one collected Body, is capable in a ſhort Space of Time of producing marvellous Effects: And yet, I ſhould not expect ſuch a Sluice, either to clear the Pool to the Depth it had 50 Years ſince, nor carry the outfall Channel out to the N. W.

this contradicts the last Paragraph —

By Sluices of this Kind, which are the only Expedient Art has found, that is comparable to a River, the greateſt Part of the Sea Ports of *Flanders* and *Holland* are kept open, under Circumſtances more unfavourable than thoſe of the Port of *Wells*; many of which Sluices are built not only with great Expence as to the uſeful Part, but with much Magnificence, as relying upon the durable Utility of their Conſtruction.——Thoſe of the *Wells* Traders that have Occaſion to viſit the Port of *Oſtend*, ſo much reſorted to at the preſent Time, will ſee a remarkable Example thereof in the grand *Sluice of Oſtend*, re-erected in the Year 1755.

A very decent admission

The *Slade* then conſiſting of 47 Acres, or ſomewhat leſs, on Account of the high Grounds incloſed therewith, as appears to me, might derive ſome occaſional advantage in Reſpect of Scouring, from the very Circumſtance of their Situation, laying behind the ancient Embankment: inſomuch, that what is alledged by ſome of the Witneſſes, may at ſome particular Time or Times be true, viz.—That when the Tide was ſpent at the Town, it came down from the *Slade*.

It ſeems well atteſted, and from the Nature of the Thing (as it appeared on my View) muſt be the Caſe, that the Surface of the *Slade* never uſed to be overflowed, but in extreme Spring Tides, here called *Rages*; and the Condition of it in growing Ruſhes and other Vegetables, peculiar to fenny freſh Waters, before its Embankment, ſhews this to be the general Caſe. And this would naturally and neceſſarily ariſe from the very contracted Channel, and Opening left between the N. E. Bank of the ancient Embankment and the high Land; ſo narrow, that it does not appear that except at ſuch Times, there would be Sufficiency

Ostend is within half a Mile of the Sluice, the Harbour being very short. A Sluice will scour a *short* Harbour but not one of five Miles in length like Wells

All the Witnesses prove that the Slade was covered at every Common Spring Tide

ficiency of Time at High Water, for the whole Surface of the *Slade*, conſidered as a Pond, to fill at High Water any Thing near the utmoſt Height of the Sea. But yet whatever Water was at ſuch Times brought upon it, would upon the ſame Principle as the Sluice, be left behind, and retained by the ſame narrow Paſſages, ſo as to require poſſibly the Whole of the ſucceeding Low Water entirely to vend it; but then it will follow, that by how much it was the longer in vending, it would come down the more leiſurely, and towards the latter Part of it, the more dribbling in Proportion as its Channel grew more contracted, by the Surface of the Water being lower therein; ſo that although it might at thoſe Times come down in good Quantity in the firſt Quarter's Ebb, and (meeting the Remains or the Waters from the ſixteen Acres of *Slade* Marſh, and other Waters from the unembanked Marſhes, that ſtill fall into the Haven Creek without paſſing the Sluice) might make a ſenſible increaſe of the Current; yet as this muſt greatly fall off, after the top Waters were gone, that it could give but little Aid in the latter Part of the Ebb, (when it was moſt wanted) muſt appear equally plain and clear; But yet whatever good Effect might be aſcribed to the Water from the Slade, or in Reality it might have, when it could operate in the Manner I have pointed out; yet as it appears from equal Teſtimony, that thoſe Rages happen but ſeldom (4 or 5 Times in a Year) they could yet be of no material Benefit; becauſe, their Power of Scouring and Grinding the Bottom, (in as much as the Sea is inceſſantly bringing in a freſh Acceſſion of Sand, Silt, and Mud) muſt be in Proportion to their frequency; ſo that if it was to be ſuppoſed (what it does not appear to me reaſonable to admit) that the Effects of the Slade Waters were, when they happened, even equal with that of the Sluice; yet the Sluice, if we lay the Neap Tides out of the Account, operating 365 good Tides in a Year, and thoſe but 5, the Benefit could only be 70 to 1, an Effect ſo ſmall, that when mixed with many others, could not be perceived; and though in the Eye of Reaſon, every Thing that operates at all, muſt have an Effect, yet it clearly appears to me, that the Effect to be expected either by a Shutting up, or the Opening thoſe Marſhes in the Manner they were before the Embankment in 1758*, could procure no ſuch beneficial Effect upon the Harbour, as to prevent the Neceſſity of ſupporting and continuing the Sluice, or even to be of any meaſurable or eſtimable Degree of Value; and that this Explanation of the ſmall Utility to be derived or expected from the Slade Marſh Waters, is in Reality the true one, is proved by the Facts already ſtated; viz. that before the Year 1738, they had *proved totally ineffectual*; and had always ſo proved ever ſince, whenever the Sluice was out of Order. I muſt therefore conclude in the Sentiment of Mr. *Mylne*, that whoever would find a Cauſe for the Alteration of the Courſe of the Out Channel, for the filling up of the Pool; for the Landing up of the Harbour, Channel, or Creek; and in general for the decaying State of the Harbour of *Wells*, muſt ſeek ſome Cauſe, widely different from the Embankment of the Slade Marſhes in the Year 1758; and the Remedy from Human Induſtry and Art, in ſomething more powerful, and better adapted, than any of the Sluices already conſtructed appear to have been.

J. SMEATON.

London, *May* 4*th*. 1782.

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* I ſay in the Manner they were before the Year 1758, that is *when there was no Bank at all*: becauſe if a *Partial Breach* was made in the Bank, the Waters iſſuing through this Breach, would have an Effect ſimilar to the Sluice, till worn by the entering and iſſuing Waters, too wide to produce the Effect; as was the Caſe when Freeſtone's Sluice was worn too wide, it ceaſed to do its Duty.

MAY 24, 1782.

Mr. SMEATON's REPORT,

ON THE

State of WELLS, HARBOUR.

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W. Jones